SECTION 02593 - HIGH DENSITY POLYETHYLENE PRESSURE PIPE

City of San Diego, CWP Guidelines

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NTS: This specification covers use of polyethylene pressure pipe to convey anaerobic digester gas. The Specifier shall carefully consider temperature effects on the pipe.

Expansion and Contraction: HDPE pipe has a relatively large coefficient of thermal expansion (approximately 1.4 inches per 100 feet per 10 F degrees change), and the Specifier shall provide for thermal effects during installation, digester startup and shutdown, and steady state operation.

Pressure Ratings: The Specifier shall consider the service temperatures and pressures in selecting wall thicknesses which are specified by standard dimension ratio (SDR). Do not select a thinner wall (higher SDR) than the following table:

Maximum Pressure Rating vs. Wall Thickness and Temperature

Temperature degrees F	Hydrostatic Design Basis, psi	Pipe SDR								
		32.5	26	21	19	17	15.5	13.5	11	9.3
73.4	1600	51 psi	64 psi	80 psi	90 psi	100 psi	110 psi	128 psi	160 psi	190 psi
80	1520	48 psi	60 psi	76 psi	85 psi	95 psi	105 psi	122 psi	150 psi	182 psi
90	1390	44 psi	56 psi	70 psi	77 psi	87 psi	96 psi	111 psi	140 psi	167 psi
100	1260	40 psi	50 psi	63 psi	70 psi	79 psi	87 psi	101 psi	125 psi	150 psi
110	1130	36 psi	45 psi	57 psi	63 psi	71 psi	78 psi	90 psi	113 psi	135 psi
120	1000	32 psi	40 psi	50 psi	56 psi	63 psi	69 psi	80 psi	100 psi	120 psi
130	900	28 psi	36 psi	45 psi	50 psi	56 psi	62 psi	72 psi	90 psi	108 psi

In buried applications, also consider depth of cover, vertical deflection limit of 5 percent, and soil characteristics in specifying SDR, backfill material, and compaction. Consider including Standard Detail C-194 for flexible pipe to clarify trenching terminology, dimensions, and backfill types. Coordinate backfill material requirements and compaction requirements with the recommendations of the Geotechnical Report.

HDPE pipe is not recommended for "mechanical" piping service which connects compressor equipment, valves, and appurtenances, or any location where gas temperatures might exceed 130 degrees F. Gas compressors must not create an oil mist or other contamination which may degrade the pipe. Specify thermal insulation where the pipe may be exposed to solar heating temperature swings of 20 F degrees.

This Section is oriented toward intraplant transmission service where gas company and CalTrans requirements do not apply.

This Section is coordinated with Section 02600 such that it requires a customized version of that section be included in the Technical Specifications.

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PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing polyethylene pressure pipe to convey digester gas.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specification, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 01530 Protection of Existing Facilities

2. Section 15030 Piping Identification Systems

3. Section 02200 Earthwork

4. Section 02600 Pipeline Construction

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

ANSI/ASME B 31.1	Power Piping
ASTM D 2321	Standard Practice for Underground Installation of the Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
ASTM D 2513	Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D 2657	Standard Practices for Heat-Joining Polyolefin Pipe and Fittings
ASTM D 3350	Polyethylene Plastic Pipe and Fittings Materials

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Pipe manufacturer's name and product identification, including manufacturer's technical data on dimensions and stiffness, jointing instructions, stress-time rupture data and extrapolation for proposed resin, and verification of compliance with referenced standards.

2. Shop drawings of pipe supports including details of concrete inserts and anchors.

PART 2 -- PRODUCTS

2.1 PIPE

A. General: Pipe shall be of the diameter, wall thickness, eccentricity, ovality, dimensions, tolerances, and have the markings of ASTM D 2513 including Annex A1. [Unless indicated otherwise, the Standard Dimension Ratio (SDR) shall be 11].

B. Material: High density polyethylene resin shall be ASTM D 3350, type PE 3408 with cell classification 345434C. Color shall be black, and material shall be UV-stabilized.

C. **Joints and Fittings:**

1. Joints shall be butt fusion type complying with ASTM D 2657.

2. Fittings shall be molded, with pressure classification equal to the pipe.

2.2 PIPE SUPPORTS

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NTS: If the exposed portion of the pipeline which must be supported can be installed at temperatives within 10 F degrees of its intended operating temperature, calculate the support spacing below based on the pipe flowing 1/4 diameter full of water analyzed as a simple continuous beam with no more than 1/4-inch maximum deflection. If the installation temperature criterion cannot be met, either provide continuous support or specify pipe at one SDR step more conservative than selected above but space supports as if the pipe were SDR 32.5.

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A. Exposed pipe shall be properly supported to prevent deflection and stresses and shall be as indicated. Supports shall be sliding type with extra wide saddles complying with ANSI B 31.1.

B. Support spacing shall be:

Nominal Pipe Size (inches)	SDR	MaximumSpan (inches)
[ ]	[ ]	[ ]
[ ]	[ ]	[ ]

C. Pipe hangers shall be capable of supporting the pipe and shall allow for free expansion and contraction of the pipe. Hangers shall have a means of vertical adjustment after erection. Hangers shall be designed so that they cannot become disengaged by any movement of the pipe. Hanger rods shall be subject to tensile loading only.

D. At hanger locations where lateral or axial movement occurs, suitable linkage shall be provided to allow movement. Where horizontal movement is greater than 1/2-inch or hanger rod deflection from vertical is greater than 4 degrees from minimum to maximum temperature, the rod and structural attachment shall be installed offset in such a manner that the rod is vertical at the pipe operating temperature.

[2.3 PIPE INSULATION

A. Pipe and fittings shall be insulated where indicated. Insulation shall be molded fibrous glass material with minimum k-factor of 0.23. Thickness shall be [1-1/2] inches. Insulation shall have a factory-

applied white fire retardant vapor barrier jacket of kraft paper and aluminum foil laminated together. The outside jacket shall be smooth aluminum or plastic, held in place by 1/2-inch wide Type 3003 aluminum or stainless steel strapping.]

2.4 FILL AND BACKFILL MATERIAL

A. Bedding and pipe zone material shall be sand. Fill and backfill materials shall be in accordance with Section 02600.

PART 3 -- EXECUTION

3.1 PRODUCT HANDLING AND STORAGE

A. Pipe shall be laid out, stored, and handled in accordance with Section 02600 and the following.

B. Pipe may be stacked or stored on the ground, but it shall not be pierced, scarred or gouged by stones or sharp objects. Do not stack higher than the manufacturer recommends.

C. Handle pipe to prevent damage. When lifting segments of pipe, use wide web nylon slings or equivalent instead of chains or cable-type chokers. Use spreader bars when lifting long, joined sections. Care shall be exercised to avoid cutting or gouging the pipe.

3.2 JOINTS

A. Sections of polyethylene pipe and fittings shall be joined into continuous lengths at the trench side as much as possible. The joining method shall be the thermal butt fusion method, performed in strict accordance with the pipe manufacturer's recommendations and producing joint strength equal to or greater than the pipe strength. Fusion equipment used in the joining procedure shall be capable of meeting all requirements of the pipe manufacturer, including fusion temperature, alignment, and fusion pressure.

B. Butt fusion shall conform to ASTM D 2657 and pipe manufacturer's criteria for the type of joining. The strength of the fused joint shall be equal to that of the pipe itself.

C. Fusion equipment shall be operated only by technicians who have been certified by a gas public utility or by the fusion equipment supplier.

3.3 INSTALLATION ABOVEGROUND

A. Pipe, fittings, supports, and appurtenances shall be installed in accordance with the manufacturer's instructions or as indicated, whichever is more stringent.

3.4 INSTALLATION IN TRENCH

A. General: Pipe shall be installed in accordance with the pipe manufacturer's recommendations, Section 02600, and the requirements herein.

B. Excavation: Unless indicated otherwise, excavation shall be in accordance with Section 02600.

C. Laying: Lay the pipe in accordance with ASTM D 2321, Section 7. Allow extra length of pipe to compensate for contraction in the cooler trench bottom. Keep the pipe interior clean and dry during and after laying.

D. Pipe location shall be marked with metal strip and orange polyethylene caution tape reading "Biogas" in accordance with Section 15030.

E. Backfilling and compaction shall be in accordance with ASTM D 2321, subsection 7.5.

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NTS: Set the testing pressure at 1.5 times the rated operating pressure of the pipeline.

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3.5 Field Testing

A. Test for leaks by air pressure testing at [ ] psi. After plugging both ends of the pipe, pressurize the pipe and hold for 5 hours to establish equilibrium. Do not allow oil mist from the compressor to enter the pipe. Reset the pressure and observe for any pressure loss for 3 hours. Any pressure loss shall be an indication of defective pipe, and the CONTRACTOR shall make repairs at no additional cost to the OWNER until the pipe passes the test.

** END OF SECTION **